

LED Measurement Series:

Solid-State Lighting Standards

Like traditional lighting products, LED-based luminaires sold in the US are subject to industry standards governing safety and performance. To accommodate LEDs, some existing standards and test procedures are being modified, while in other cases, new standards have been developed. This fact sheet lists the key performance and safety standards applicable to LED-based lighting products.

Product Performance and Measurement Standards

ANSI/NEMA Standards

ANSI/NEMA oversees the creation, promulgation and use of thousands of industry norms and guidelines, including the following key standards of relevance to SSL products.

C78.377-2008	Specifications for the Chromaticity of Solid State Lighting Products <ul style="list-style-type: none"> Specifies the recommended chromaticity (color) ranges for white light LEDs with various correlated color temperatures (CCTs).
NEMA SSL-1 [†]	Power Supply <ul style="list-style-type: none"> Will specify operational characteristics and electrical safety of SSL power supplies and drivers.
C82.77-2002	Harmonic Emission Limits – Related Power Quality Requirements for Lighting <ul style="list-style-type: none"> Specifies the maximum allowable harmonic emission of SSL power supplies.

IESNA Documents

IESNA is the recognized North American technical authority on illumination.

TM-16-05	IESNA Technical Memorandum on Light Emitting Diode (LED) Sources and Systems <ul style="list-style-type: none"> This technical memorandum provides a general description of LED devices and systems, and answers common questions about the use of LEDs.
RP-16-05 Addendum a	Nomenclature and Definitions for Illuminating Engineering <ul style="list-style-type: none"> This document provides industry standard definitions of lighting terms, including all lighting technologies. Addendum a provides definitions of solid state lighting terms.
LM-79-08	IESNA Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products <ul style="list-style-type: none"> Specifies procedures for measuring total luminous flux, electrical power, luminous efficacy, and chromaticity of SSL luminaires and replacement lamp products.
LM-80-08	IESNA Approved Method for Measuring Lumen Maintenance of LED Light Sources <ul style="list-style-type: none"> Specifies procedures for determining lumen maintenance of LEDs and LED modules (but not luminaires) related to effective useful life of the product.
TM-21 [†]	Lumen Depreciation Lifetime Estimation Method for LED Light Sources <ul style="list-style-type: none"> Will provide a method for determining an LED luminaire or integral replacement lamp's expected operating life, based on initial performance data collected per IES-LM-80.
LM-XX [†]	Method for the Measurements of High-Power LEDs <ul style="list-style-type: none"> Will provide a standardized method for thermal, electrical and photometric measurements of high-power LEDs.

[†]Currently under development.



Photo credit: Labsphere

Standards Organizations

ANSI - American National Standards Institute, www.ansi.org

CIE - International Commission on Illumination, www.cie.co.at

FCC - Federal Communications Commission, www.fcc.gov

IEC - International Electrotechnical Commission, www.iec.ch

IESNA - Illuminating Engineering Society of North America, www.iesna.org

NEMA - National Electrical Manufacturers Association, www.nema.org

NFPA - National Fire Protection Association, www.nfpa.org

UL - Underwriters Laboratories Inc., www.ul.com

CIE Reference Publications

13.3-1995

Method of Measuring and Specifying Colour Rendering Properties of Light Sources

- The official document defining the CRI metric. Referenced by ANSI C78.377.

15:2004

Colorimetry, Third Edition

- The official document defining various CIE chromaticity and CCT metrics. Referenced by ANSI C78.377.

127:2007

Measurements of LEDs

- Addresses LED luminous intensity measurement; applies only to individual LEDs, not to arrays or luminaires.

S 009/E:2002

Photobiological Safety of Lamps and Lamp Systems

- Specifies measurement techniques to evaluate optical radiation hazards and eye safety risks of LEDs and LED clusters.



Safety, Installation, and Other Requirements

NFPA Requirements

70-2005	<p>National Electrical Code</p> <ul style="list-style-type: none"> Most SSL products must be installed in accordance with the National Electrical Code.
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FCC Requirements

47 CFR Part 15	<p>Radio Frequency Devices</p> <ul style="list-style-type: none"> Specifies FCC requirements for maximum allowable unintended radio-frequency emissions from electronic components, including SSL power supplies and electronic drivers.
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UL Standards

UL is currently developing a safety standard for “Light-Emitting Diode (LED) Light Sources for Use in Lighting Products,” which will be designated UL standard 8750. Currently, UL has in place an “Outline of Investigation” (also numbered 8750) that references all existing UL standards applicable to LED lighting products. The purpose of the outline is to provide a comprehensive approach and listing of applicable standards for UL treatment of lighting products based on LEDs. The Outline will be used until the full LED specific document is completed. The table below lists the key UL standards referenced in the Outline.

8750†	<p>Outline of Investigation for Light-Emitting Diode (LED) Light Sources for Use in Lighting Products</p> <ul style="list-style-type: none"> Will specify the minimum safety requirements for SSL components, including LEDs and LED arrays, power supplies, and control circuitry.
1598	<p>Luminaires</p> <ul style="list-style-type: none"> Specifies the minimum safety requirements for luminaires. The requirements in this document may be referenced in other documents such as UL 8750 or separately used as part of the requirements for SSL products.
153	<p>Portable Electric Luminaires</p> <ul style="list-style-type: none"> Specifies the minimum safety requirements for corded portable luminaires.
1012	<p>Power Units Other Than Class 2</p> <ul style="list-style-type: none"> Specifies the minimum safety requirements for power supplies other than Class 2 (as defined in NFPA 70-2005).
1310	<p>Class 2 Power Units</p> <ul style="list-style-type: none"> Specifies the minimum safety requirements for Class 2 power supplies (as defined in NFPA 70-2005).
1574	<p>Track Lighting Systems</p> <ul style="list-style-type: none"> Specifies the minimum safety requirements for track lighting systems.
2108	<p>Low Voltage Lighting Systems</p> <ul style="list-style-type: none"> Specifies the minimum safety requirements for low-voltage lighting systems.
60950-1	<p>Information Technology Equipment – Safety – Part 1: General Requirements</p> <ul style="list-style-type: none"> Specifies the minimum safety requirements for electronic hardware.

†Currently under development.

Disclaimer: This list is not comprehensive, as other existing and future industry standards, recommended practices, and regulatory requirements may apply to specific solid state lighting products.

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For more information contact:

EERE Information Center
1-877-EERE-INF
(1-877-337-3463)
www.eere.energy.gov

For Program Information on the Web:

www.ssl.energy.gov
DOE sponsors a comprehensive program of SSL research, development, and commercialization.

For Program Information:

Robert Lingard
Pacific Northwest National Laboratory
Phone: (503) 417-7542
E-mail: robert.lingard@pnl.gov

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Energy Efficiency and Renewable Energy

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